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First Named Inventor	Hill et al.
Art Unit	2823
Examiner Name	H. Lee
Attorney Docket Number	2269-3380.1US (97-0842.1/US)

ENCLOSURES ***(check all that apply)***

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment / Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
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  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☒ Appeal Brief; Claims Appendix
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) *(please identify below)*:

Remarks

The Commissioner is authorized to charge any additional fees required but not submitted with any document or request requiring fee payment under 37 C.F.R. §§ 1.16 and 1.17 to Deposit Account 20-1469 during pendency of this application.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm	Trask Britt, P.C.		
Signature			
Printed Name	Brick G. Power		
Date	March 8, 2007	Reg. No.	38,581

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTEFERENCES

In re Application of:

Hill et al.

Serial No.: 10/067,410

Filed: February 4, 2002

For: METHOD FOR FORMING A SELECTIVE CONTACT AND LOCAL INTERCONNECT IN SITU (as amended)

Confirmation No.: 8302

Examiner: H. Lee

Group Art Unit: 2823

Attorney Docket No.: 2269-3380.1US

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APPEAL BRIEF

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
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Attn: Board of Patent Appeals and Interferences

Sirs:

This APPEAL BRIEF is being submitted in the format required by 37 C.F.R. § 41.37(c)(1). The fee required by 37 C.F.R. § 41.20(b)(2) has already been paid.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal of the final rejections that have been presented in U.S. Application Serial No. 10/067,410 (hereinafter "the '410 Application) is Micron Technology, Inc., the assignee of the '410 Application, as evidenced by the Assignment recorded with the United States Patent and Trademark Office on April 7, 1998, Reel 9119, Frame 0645.

II. RELATED APPEALS AND INTERFERENCES

Appellant is not aware of any related applications that are on appeal or subject to other proceedings before the Board of Patent Appeals and Interferences (hereinafter "the Board"), or of any other proceedings involving related application that would influence or affect the Board's decision in the above-referenced appeal.

III. STATUS OF CLAIMS

There are currently twenty-eight (28) claims pending and under consideration in the '410 Application. All twenty-eight claims stand finally rejected. The final rejections of claims 1-28 are being appealed.

IV. STATUS OF AMENDMENTS

The most recent claim amendments the '410 Application were introduced in an Amendment under 37 C.F.R. § 1.116 that was filed on October 20, 2004.

Three Office Actions were issued following the Amendment of October 20, 2004, with each rejection based upon the same art. Despite numerous explanations as to the patentability of

claims 1-28, substantially the same the same rejections were presented in the final Office Action of April 3, 2006, in which the Examiner merely withdrew his reliance upon one reference (U.S. Patent 6,699,530 to Danek et al.) from each of the previously presented rejections. Those rejections were maintained in an Advisory Action dated June 16, 2006.

Accordingly, a Notice of Appeal was filed in the '410 Application on June 23, 2006, and is followed by this Appeal Brief, which is being submitted within two months of the date on which the Notice of Appeal was filed.

No amendments have been presented in the '410 Application since the final Office Action of April 3, 2006, was issued.

V. SUMMARY OF CLAIMED SUBJECT MATTER

While reference characters are used in the following summary to identify examples of claim elements that are shown in the drawings, it is noted that the reference characters are included merely to ensure full compliance with the requirements of 37 C.F.R. § 41.37(c)(1)(v), and that their inclusion merely points to examples in the as-filed disclosure that do not limit the scope of any claim that remains pending in the above-referenced application. Rather, the scope of each claim is limited only by the plain language thereof, and includes the full scope of available equivalents to each recited element.

Independent claim 1 of the '410 Application is directed to a method that includes selective deposition of metal silicide and the subsequent, in situ, deposition of an interconnect material. *See, e.g.,* page 5, lines 15-23 (paragraph **[0013]**). The method of independent claim 20 of the '410 Application includes selective deposition of a contact material and the subsequent, in

situ, deposition of an interconnect material. *See, e.g.,* page 5, lines 15-23 (paragraph **[0013]**). Without limiting the scopes of the claims, the metal silicide or contact material may include, but is not limited to titanium silicide, tungsten silicide, molybdenum silicide, and/or platinum silicide (page 7, line 23, to page 8, line 2 (paragraph **[0027]**)), while the interconnect material may include, without limitation, titanium nitride (page 9, line 24, to page 10, line 12) paragraph **[0034]**)).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

(A) The 35 U.S.C. § 103(a) rejections of claims 1, 8-10, 12-14, 18-20, 23, and 25-28 for reciting subject matter which is assertedly unpatentable over the subject matter taught in U.S. Patent 6,020,259 to Chen et al. (hereinafter "Chen");

(B) The rejections of claims 2-5 and 21-22 under 35 U.S.C. § 103(a) for being drawn to subject matter that is allegedly unpatentable over that taught in Chen, in view of teachings from U.S. Patent 5,043,299 to Chang et al. (hereinafter "Chang");

(C) The rejections of claims 6 and 7 under 35 U.S.C. § 103(a) for being directed to subject matter that is allegedly unpatentable over teachings from Chen, in view of the teachings of U.S. Patent 5,162,259 to Kolar et al. (hereinafter "Kolar");

(D) The 35 U.S.C. § 103(a) rejections of claims 11 and 24 for being drawn to subject matter which is purportedly unpatentable over the subject matter taught in Chen, in view of teachings from U.S. Patent 5,821,164 to Kim et al. (hereinafter "Kim"); and

(E) The rejections of claims 15-17 under 35 U.S.C. § 103(a) for reciting subject matter that is allegedly unpatentable over the subject matter taught in Chen, in view of teachings from U.S. Patent 6,001,729 to Shinriki et al. (hereinafter "Shinriki").

VII. ARGUMENT

Claims 1-28 have been finally rejected under 35 U.S.C. § 103(a).

(A) LEGAL AUTHORITY

The standard for establishing, maintaining, and upholding a rejection under 35 U.S.C. § 103(a) is set forth in M.P.E.P. § 706.02(j), which provides:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The burden is on the Office to demonstrate that a reference teaching is inherent. M.P.E.P. § 2112. The following guidance has been provided by M.P.E.P. § 2112 in determining whether or not this burden has been met:

> The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish inherency of that result or characteristic. *In re Rijckaert,* 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) . . . 'To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in

the reference, and that it would be so recognized by persons of ordinary skill . . .'' *In re Robertson,* 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1991).

(B) REFERENCES RELIED UPON

Chen

Chen teaches a process that includes selectively depositing titanium silicide on a surface of a silicon substrate that is exposed through a contact opening, then blanket depositing titanium nitride over the interconnect. Col. 3, lines 2-26. Chen does not include any teaching or suggestion that these deposition processes may be effected *in situ*.

Chang

Chang is relied upon for its teachings that relate to exposing doped areas of semiconductor device structures to a plasma including activated species of nitrogen or hydrogen. Final Office Action, page 4.

Kolar

Kolar is relied upon for its teaching that metal silicide layers may, prior to depositing interconnect materials thereover, be cleaned with hydrochloric acid. Final Office Action, page 5.

Kim

Kim teaches that titanium nitride may be selectively deposited in to contact holes. Final Office Action, page 6. Kim asserts that a conductive layer 16, which may be formed from a material such as aluminum, copper, titanium, or titanium nitride, may be "selectively deposited

on the exposed surface of [an] interlevel layer 14a[,] including [a] contact hole 15[therethrough]." Col. 4, lines 24-27. FIG. 2f of Kim, however, shows that the interlevel layer 14a covers the entire substrate 11, and that the entire upper surface of interlevel layer 14 appears to be exposed. Moreover, the formation of conductive layer 16 must be followed by an etch-back, as explained at col. 4, lines 28-31 of Kim, to remove conductive material from the upper surface of the interlevel layer 14a and, thus, to define conductive lines 16 within the contact holes 15.

Shinriki

Shinriki teaches that titanium silicide may be selectively deposited by reacting a metallic precursor with a silicon compound. Final Office Action, page 6.

(C) ANALYSIS

(1) CHEN

Claims 1, 8-10, 12-14, 18-20, 23, and 25-28 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over the subject matter taught in Chen.

The Examiner has asserted that Chen implicitly discloses the desirability of depositing the interconnect material *in situ* with the chemical reaction to deposit metal silicide because Chen teaches carrying out both processes using the same chemical vapor deposition (CVD) technique. Final Office Action, page 4. The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a

whole would have suggested to those of ordinary skill in the art. *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000).

Notably, the explicit teachings of Chen are limited to introducing a set of reactants into a chamber to deposit titanium silicide (col. 3, lines 2-19), then introducing another set of reactants into a reaction chamber to deposit titanium nitride (col. 3, lines 20-26).

There is no reason that one skilled in the art would be expected to draw the inference that separate chemical reactions with different reactants would take place in the same reaction chamber simply because chemical vapor deposition (CVD) processes are used to effect both reactions. Teaching that CVD may be used to deposit different layers on a semiconductor implies nothing other than that a certain type of process, with different reactions at discrete points in time, may be used to form layers of different materials.

Without actually teaching or suggesting that the two reactions of Chen are effected in the same chamber, or *in situ,* one cannot imply anything more from the disclosure of Chen. This is particularly true since different material layers have conventionally been formed in different reaction chambers, even if the same general process (*e.g.,* CVD) was used form both material layers.

Thus, Chen does not teach or suggest "depositing an interconnect material onto . . . metal silicide after and in situ with causing [a] chemical reaction" "to selectively deposit metal silicide" on the "surface of at least one exposed, doped area of [a] semiconductor device structure," as required by independent claim 1.

Claims 8-10, 12-14, 18, and 19 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

Chen also lacks any teaching or suggestion of "depositing an interconnect material onto [a] contact material after and in situ with causing [a] chemical reaction" "to selectively deposit [the] contact material" on an "exposed active device region of [a] semiconductor device structure," as required by independent claim 20.

Each of claims 23 and 25-28 is allowable, among other reasons, for depending directly or indirectly from claim 20, which is allowable.

The Examiner has also asserted that the motivation to combine the teachings of Chen with an *in situ* process "is to provide a better process for forming the metal silicide and the interconnect material in the same reaction chamber to avoid undesirable contamination." Final Office Action, pages 4-5. Notably, determinations of obviousness "should be based on evidence rather than on mere speculation or conjecture." *Alza Corp. v. Mylan Labs., Inc.*, 464 F.3d 1286 (Fed. Cir. 2006).

As Chen lacks any teaching or suggestion that two different material layers may be deposited *in situ,*, and since the Examiner has not provided any other support for the purported obviousness of effecting two different reactions in the same chemical vapor deposition chamber, one of ordinary skill in the art would not have been motivated, without the benefit of hindsight provided by the claims that remain pending in the '410 Application, to modify the teachings of Chen in the manner that has been asserted.

Therefore, it is respectfully submitted that Examiner has not met his burden of establishing a *prima facie* case of obviousness against any of claims 1, 8-10, 12-14, 18-20, or 25-28, as would be required to uphold the 35 U.S.C. § 103(a) rejections of these claims.

In view of the foregoing, it is respectfully submitted that there are at least two reasons that the teachings of Chen do not support a *prima facie* case of obviousness against any of claims 1, 8-10, 12-14, 18-20, 23, or 25-28.

As a *prima facie* case of obviousness has not been established against independent claim 1 or independent claim 20, it is respectfully submitted that these claims are allowable under 35 U.S.C. § 103(a).

Claims 8-10, 12-14, 18, and 19 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

Each of claims 23 and 25-28 is allowable, among other reasons, for depending directly or indirectly from claim 20, which is allowable.

(2) CHEN IN VIEW OF CHANG

Claims 2-5 and 21-22 have been rejected under 35 U.S.C. § 103(a) for being drawn to subject matter that is allegedly unpatentable over teachings from Chen, in view of the teachings of Chang.

Claims 2-5 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

Claims 21 and 22 are both allowable, among other reasons, for depending directly and indirectly, respectively, from claim 20, which is allowable.

Claim 22 is further allowable since neither Chen nor Chang, taken together or separately, teaches or suggests exposing a semiconductor device structure to a nitrogen-ammonia plasma. While the Examiner has asserted, at page 5 of the Final Office Action, that use of a

nitrogen-ammonia plasma would be obvious depending upon the type of material to be cleaned, the Examiner has not shown any art that discloses use of such a plasma.

(3) CHEN IN VIEW OF KOLAR

Claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is purportedly unpatentable over the teachings of Chen, in view of teachings from U.S. Patent 5,162,259 to Kolar et al.

Claims 6 and 7 are both allowable, among other reasons, for depending directly and indirectly, respectively, from claim 1, which is allowable.

(4) CHEN IN VIEW OF KIM

Claims 11 and 24 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in Chen et al., in view of teachings from U.S. Patent 5,821,164 to Kim et al. (hereinafter "Kim").

Claim 11 is allowable, among other reasons, for depending directly from claim 1, which is allowable.

Claim 24 is allowable, among other reasons, for depending directly from claim 20, which is allowable.

Furthermore, a *prima facie* case of obviousness has not been established against either claim 11 or claim 24. Kim has been relied upon for purportedly teaching that an interconnect material may be selectively deposited. Kim even asserts that a conductive layer 16, which may be formed from a material such as aluminum, copper, titanium, or titanium nitride, may be

"selectively deposited on the exposed surface of [an] interlevel layer 14a[,] including [a] contact hole 15[therethrough]." Col. 4, lines 24-27. From FIG. 2f of Kim, however, it appears that the interlevel layer 14a covers the entire substrate 11, and that the entire upper surface of interlevel layer 14 appears to be exposed. Moreover, the formation of conductive layer 16 must be followed by an etch-back, as explained at col. 4, lines 28-31 of Kim, to remove conductive material from the upper surface of the interlevel layer 14a and, thus, to define conductive lines 16 within the contact holes 15. Thus, deposition of the conductive layer 16 would certainly not be selective.

Chen also lacks any teaching or suggestion of selectively depositing an interconnect material.

As claims 11 and 24 both require that an interconnect material be selectively deposited, according to the ordinary meaning of that term, as used in the art, the teachings of Kim cannot be combined with teachings from Chen in such a way as to establish a *prima facie* case of obviousness against either of these claims.

(5) CHEN IN VIEW OF SHINRIKI

Claims 15-17 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is allegedly unpatentable over the subject matter taught in Chen, in view of teachings from U.S. Patent 6,001,729 to Shinriki et al.

Claims 15-17 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

VIII. CLAIMS APPENDIX

The current status of each claim that has been introduced into the '799 Application is set forth in CLAIMS APPENDIX to this Appeal Brief.

IX. EVIDENCE APPENDIX

No evidence has been submitted pursuant to 37 C.F.R. §§ 1.130, 1.131, or 1.132. Accordingly, no evidence appendix accompanies this Appeal Brief.

X. RELATED PROCEEDINGS APPENDIX

No decisions have been rendered by the Board or any court in a related application. Therefore, this Appeal Brief is not accompanied by a related proceedings appendix.

XI. CONCLUSION

It is respectfully submitted that:

(A) Claims 1, 8-10, 12-14, 18-20, 23, and 25-28 are allowable under 35 U.S.C. § 103(a) for reciting subject matter which is patentable over the subject matter taught in Chen;

(B) Claims 2-5 and 21-22 are allowable under 35 U.S.C. § 103(a) for being drawn to subject matter that is patentable over that taught in Chen, in view of teachings from Chang;

(C) Claims 6 and 7 are allowable under 35 U.S.C. § 103(a) for being directed to subject matter that is patentable over teachings from Chen, in view of the teachings of Kolar;

(D) Claims 11 and 24 are allowable under 35 U.S.C. § 103(a) for being drawn to subject matter which is patentable over the subject matter taught in Chen, in view of teachings from Kim; and

(E) Claims 15-17 are allowable under 35 U.S.C. § 103(a) for reciting subject matter that is patentable over the subject matter taught in Chen, in view of teachings from Shinriki.

Accordingly, it is respectfully requested that the 35 U.S.C. § 103(a) rejections of claims 1-28 be reversed, and that each of these claims be allowed.

Respectfully submitted,

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CLAIMS APPENDIX

1. A method for fabricating an interconnect adjacent a contact of a semiconductor device structure, comprising:

causing a chemical reaction adjacent to a surface of at least one exposed, doped area of the semiconductor device structure to selectively deposit metal silicide thereon without reacting material of the at least one exposed, doped area ; and

depositing an interconnect material onto the metal silicide after and in situ with causing the chemical reaction.

2. The method of claim 1, further comprising exposing the at least one exposed, doped area of the semiconductor device structure to a plasma.

3. The method of claim 2, wherein exposing comprises exposing the at least one exposed, doped area of the semiconductor device structure to a plasma comprising an activated species of at least one of nitrogen, hydrogen, and ammonia.

4. The method of claim 1, further comprising cleaning the semiconductor device structure.

5. The method of claim 4, wherein cleaning includes employing a cleaning agent comprising at least one of chlorine, hydrochloric acid, and hydrofluoric acid.

6. The method of claim 1, further comprising cleaning the semiconductor device structure after depositing said metal silicide.

7. The method of claim 6, wherein cleaning includes employing a cleaning agent comprising at least one of chlorine, hydrochloric acid, and hydrofluoric acid.

8. The method of claim 1, wherein causing the chemical reaction results in deposition of titanium silicide.

9. The method of claim 1, wherein depositing the interconnect material comprises blanket depositing the interconnect material.

10. The method of claim 9, further comprising patterning the interconnect material.

11. The method of claim 1, wherein depositing the interconnect material comprises selectively depositing the interconnect material.

12. The method of claim 1, further comprising depositing a layer comprising electrically conductive material over the interconnect material.

13. The method of claim 12, further comprising patterning the layer.

14. The method of claim 1, wherein depositing the interconnect material comprises depositing at least one of titanium and titanium nitride.

15. The method of claim 1, wherein causing the chemical reaction comprises reacting a metallic precursor with a silicon-containing compound.

16. The method of claim 15, wherein reacting comprises reacting a metallic precursor comprising at least one of a titanium tetrahalide, a subhalide, and a $Ti(NR_2)_4$, where R is selected from the group consisting of hydrogen and alkyl groups, with the silicon-containing compound.

17. The method of claim 15, wherein reacting comprises reacting the metallic precursor with a silicon-containing compound comprising at least one of a silane, a dichlorosilane, and a Si_nH_{2n+2}, where n is an integer equal to zero or more.

18. The method of claim 1, wherein depositing the interconnect material comprises reacting a metallic precursor with a reactant comprising at least one of ammonia, nitrogen trifluoride, an organic silane reactive gas, and an activated species.

19. The method of claim 18, wherein reacting comprises reacting a metallic precursor comprising at least one of a titanium tetrahalide and a $Ti(NR_2)_4$, where R is selected from the group consisting of hydrogen and alkyl groups, with the reactant.

20. A method for fabricating a selective contact and a local interconnect on a semiconductor device structure, comprising:

causing a chemical reaction adjacent to an exposed active device region of the semiconductor device structure to selectively deposit a contact material thereon without reacting a material of the active device region; and

depositing an interconnect material onto the contact material after and in situ with causing the chemical reaction.

21. The method of claim 20, further comprising exposing the semiconductor device structure to a plasma.

22. The method of claim 21, wherein exposing comprises exposing the semiconductor device structure to a nitrogen-ammonia plasma.

23. The method of claim 20, further comprising depositing an electrically conductive material onto the interconnect material.

24. The method of claim 20, wherein depositing the interconnect material comprises selectively depositing the interconnect material.

25. The method of claim 20, wherein depositing the interconnect material comprises blanket depositing the interconnect material.

26. The method of claim 25, further comprising patterning the interconnect material to form at least one interconnect therefrom over the contact material.

27. The method of claim 20, wherein causing the chemical reaction comprises depositing a selective contact material.

28. The method of claim 27, wherein depositing the selective contact material comprises depositing a metal silicide.